PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

VOL. II. | 1845–6. | No. 28.

Sixty-Third Session.

Monday, 16*th February* 1846.

The following Donations of Books to the Library were announced:—

Journal of the Asiatic Society of Bengal.—No. 161.—*By the Society.*

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. Tome XXI. Nos. 17-25, and Tome XXII. Nos. 1, 2. —*By the Academy.*

The Electrical Magazine, conducted by Mr Charles V. Walker. January 1846.—*By the Editor.*

Proceedings of the Royal Society of London. No. 61.—Philosophical Transactions of the Royal Society of London, 1845. Part 2. —*By the Royal Society.*

Catalogue of Stars of the British Association for the Advancement of Science; containing the mean Right Ascensions and North Polar Distances of Eight Thousand three hundred and seventy-seven, reduced to January 1. 1850, with a Preface explanatory of their construction and application. By the late Francis Baily, D.C.L., President of the Royal Astronomical Society of London.—*By the British Association.*

Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, in the year 1843; under the direction of George Biddell Airy, Esq., M.A., Astronomer-Royal—*By the Royal Society.*

Kongl. Vetenskaps Akademiens Handlingar för Ar 1843.

Arsberättelse om Zoologiens Framsteg under Aren 1840-42. Första Delen af C. J. Sundeval.

Arsberattelse om Zoologiens Framsteg under Aren 1843-44. Andra Delen af C. H. Bohemian.

Arsberattelser om Botaniska Arbeten och Upptackter af J. E. Wikstrom.

Arsberattelse om Framstegen i Kemi och Mineralogi af Jac. Berzelius.—*By the Royal Academy of Sciences of Stockholm.*

Leçons de Géologie Pratique par L. Elie de Beaumont. Tome I.—*By the Author.*

Monday, 2d March 1846.

SIR THOMAS M. BRISBANE, Bart., President, in the Chair.

The following Communications were read:—

1. On the recent Scottish Madrepores, with Remarks on the Climatic Character of the Extinct Races. By the Rev. Dr Fleming.

The author, in this communication, referred, in the first instance, to the three species of Lamelliferous Polyparia, described in his "British Animals," Edin., 1828, exhibiting specimens of the *Caryophyllea cyathus*, and *Turbinolia borealis* of that work, together with a characteristic drawing, by the late Mrs Hibbert, of the *Pocillopora interstincta*, there alluded to as a native of the Zetland seas. He then exhibited a specimen, six pounds in weight, of the *Madrepora prolifera* of Müller, which was found last summer by fishermen, their lines having become entangled with it, in the sea between the islands of Rum and Egg. This species was known to Pontoppidan, as a native of the Norwegian seas, and is now ascertained to be a native of the Hebrides.

The author next exhibited specimens of the *Turbinolia sepulta* of the crag, together with a new and recent species from the Cape of Good Hope. In conclusion, the author observed, that while, from an acquaintance with the habits of a few *individuals*, we could safely speculate respecting the geographical and physical distribution of a species, we cannot, from our acquaintance with the history of one *species* of a genus, predicate with any confidence respecting the character of other species of the same genus. Thus, there are species of Madrepores natives of tropical seas, and there are species natives of the North seas. After illustrating his views by a reference to the species of the genera *Bos* and *Elephas*, the author closed his observations by stating, that the evidence, proving the climate, during the deposition

of the mountain limestone, to have been warmer than at present, as derived from its contained organic remains, was defective, since the organisms compared did not belong to *individuals* of the same species, but to *species* of similar genera.

2. On the principle of Vital Affinity, as illustrated by recent Observations in Organic Chemistry. Part I. By Dr Alison.

The objects of this paper were, *first*, to vindicate the use of the term affinity, and assert the principle which that term is intended to express, viz., that in living bodies ordinary chemical affinities undergo a certain change or modification, either by the addition of affinities peculiar to the living state, or the suspension of some of those which act elsewhere; and, *secondly*, to attempt, from a review of facts recently ascertained, an exposition of the laws, according to which these modifications of ordinary chemical affinities take place, and a discrimination of those changes in living bodies, which may be ascribed to them.

In proof of the first of these points, the author referred particularly to the facts known as to the formation of starch, or its allied compounds, from carbonic acid and water by an action of certain parts of living vegetables under the influence of light, whereby the carbonic acid is decomposed and oxygen evolved; maintaining that this change, essential to the condition of all organized bodies, is so distinctly at variance with the ordinary chemical relations of carbon and oxygen, and even with those which shew themselves in other parts of vegetables in the living state, and in all parts in the dead state,—that we are equally bound to regard it as a strictly vital phenomenon, as the contraction of a muscle on a stimulus; and that we cannot rightly apprehend either phenomenon unless we regard them as dependent on certain laws of vital action or of vitality.

On the second point, he observed, that the physiologist is concerned only with those formations and resolutions of organic compounds which take place in the interior of living bodies, and that, premising that the first introduction of every species of organized being into the world must have been by a miraculous interposition of Divine Power, beyond the limits of scientific inquiry, the objects of investigation in this department of physiology appear to be more definite, and the strictly vital affinities which now operate, from the commencement of the life of vegetables to the death and decomposi-

tion of animals, to be fewer and simpler than had generally been supposed.

I. The first kind of action which may be ascribed to vital affinity, he described as the mere selection and retention, by certain portions of a solid, of certain substances, whether elementary or compound, already existing in a fluid that is brought in contact with it, or what is called by some a chemical filtration. This power is exemplified in living vegetables, particularly in the appropriation by them of some of the earthy and saline matters which are brought to their roots, and the rejection of others; it is more strikingly seen in the development of the lower classes of animals, especially those of the radiata and mollusca, which have horny or earthy integuments; and it is certainly the chief power concerned in all those functions of animals, to which we give the names of absorption, secretion, and even nutrition.

In regard to this simplest form of vital affinity, the following points seem ascertained:—

1. That it is usually, if not always, performed in a perfect organized being, by an attractive agency of living or growing cells which seem always to perform the double office of extracting from the nourishing fluid the material of their own growth and reproduction, and extracting also the fluid or solid matter which they are to contain, or with which they are to be incrusted.

The matters thus consolidated from a fluid in which they previously existed, by a simple process of attraction and increased aggregation, not precipitated by any chemical separation of their component parts, assume the forms peculiar to each organized body to which they are thus added, but retain that peculiarity which in inorganic matter exists only in fluids,—that the smallest portion of them contains all the chemical ingredients which belong to the mass, and thus any crystalline arrangement is prevented.

2. That no difference, of form or of composition, can be detected in the different cells of an organized structure, to explain the difference of the matters which they thus extract; and that, in the first development of organized beings, the difference of selecting power exercised at different points of the germinal membrane, appears to be determined by no other condition than their *position*,—just as different portions of nervous matter, differing only in anatomical position, exert perfectly different vital powers, or, in the state of disease (*e. g.*, of inflammation), peculiar attractions and repulsions ap-

pear to exist, for a time, simply at particular spots of the vascular system.

The attractions by which living cells thus appropriate to themselves portions of contiguous fluids, are obviously analogous to those by which even inorganic porous substances attract different fluids with different degrees of force, and thereby produce the phenomena of endosmose and exosmose, but are broadly distinguished from them by the peculiarity of the changes thus effected, by their infinite variety, even in different parts of the same structure, and by their uniformly temporary existence.

II. The actual transformations, or new arrangements of the chemical elements which take place in living bodies, and are peculiar to them, are illustrated by the examples of the formation of starch from water and carbonic acid, oxygen escaping; and of the formation of fat from starch, carbonic acid and water escaping.

It appears to be in the *cells* of organized structures that those transformations are likewise effected; and as the action of cells in simply extracting portions of the nourishing fluid, is analogous to the physical principle of endosmose, so their action in these metamorphosis may be illustrated, but by no means explained, by comparing them to those chemical actions to which the term catalysis is applied.

Two general observations may be made on both these modifications of the power of vital affinity,—*first*, that they obviously *transferred* from the portions of matter already endowed with them, to those which, in the growth of living beings, are added to, or substituted for, those portions of matter; just as muscular fibres already existing, communicate to all the matter which is added to them by the process of nutrition, the same contractile properties which they themselves possess; *secondly*, that every portion of matter to which any such vital properties are imparted, appears to enjoy them only for a short time; losing them so rapidly that a vital process of absorption and excretion is necessary, throughout the whole existence at least of animals, to eliminate from their bodies materials which have lost these properties and reverted to the condition of dead matter.

After stating these general principles regarding vital affinities, the author made some more special remarks on the most fundamental of all the changes in organized beings which may be referred to their action, viz., the formation of starch and its allied compounds from

carbonic acid and water under the influence of light, and consequent purification of the atmosphere; and he insisted chiefly on the following points:—

1. That this change is probably gradual; the carbonic acid being taken into the juices of the plant and slowly decomposed there, more or less completely, according to circumstances, whence result not only starch or its allied compounds, but likewise different organic acids and various oils.

2. That the formation of sugar in plants is probably to be regarded rather as a simply chemical action than as a result of vital affinities; or that it is a first product of the decomposition of starch by the agency of water and oxygen.

3. That, on the other hand, the formation of lignin, containing more carbon and less oxygen, from starch or from cellulose, and from the carbonic acid and water brought into the cells, appears to be the result of a strictly vital affinity, strongest at the period of greatest vigour of the plant.

4. That in this, as in other of the metamorphoses which take place in living beings, and which he proposes farther to examine, the carbon, thus originally fixed on the earth's surface from the atmosphere, appears to be the chief material employed by nature for the formation of all organized structures, and to be invested, for that purpose, with peculiar and transient vital affinities, while oxygen hardly appears to exert any chemical powers in living bodies, different from those which it manifests elsewhere; but is taken into the interior of all living bodies, only that it may support the excretions which are continually going on in them, and resolving organized into inorganic matter; and thus, that it gradually resumes its power over the carbon which had been temporarily separated from it for the formation of the animated part of creation.

The following Donations to the Society's Library were announced:—

The Journal of Agriculture, and the Transactions of the Highland and Agricultural Society of Scotland, for March 1846.—*By the Society.*

Journal of the Asiatic Society of Bengal. No. 160, for 1845.—*By the Society.*

Life and Correspondence of David Hume. From the Papers bequeathed by his Nephew to the Royal Society of Edinburgh,

and other original sources. By John Hill Burton, Esq., Advocate. 2 vols. 8vo.—*By the Author.*

Natural History of New York. 10 vols., 4to. Geological Map of New York, published by Legislative authority in 1842.—*By the Governor and Secretary of State of New York.*

Monday, 16*th March* 1846.

The Right Rev. BISHOP TERROT, Vice-President, in the Chair.

The following Communications were read :—

1. On the Personal Nomenclature of the Romans, with an especial reference to the Nomen of Caius Verres. By the Rev. J. W. Donaldson, Author of the New Cratylus. Communicated by Bishop Terrot.

2. On the appearance of the Great Comet of 1843, at the Cape of Good Hope, with illustrative Drawings. By Professor C. P. Smyth. Communicated by the Secretary.

This comet attracted much attention from its excessive brightness at and near its perihelion passage, as well as from the length and form of its tail. The drawings were intended to represent these particulars, and the changes which occurred during the time that the comet remained visible from the Cape Observatory.

It was seen for a short time, but not generally, before the perihelion passage, which took place on the 27th February 1843; and it ceased to be visible by the naked eye towards the end of March, though it could be discerned with the telescope till the 19th April.

After passing the perihelion, this object was seen on the 3d March, about a quarter of an hour after sunset. The head then glistened like a star of the second magnitude, and had a well-defined planetary disc, about 20″ in diameter, having an envelope of rays, the brightest of which came out like wings on both sides. The tail, which was 40° long, was in form *bifid ;* its two sides were very narrow, bright and straight, the space between the sides almost as dark as the neighbouring sky. There were also two faint streamers on either side of the tail.

On the 4th March, one of the streamers had disappeared, and the space between the central streamers had become less dark. The planetary disc was also less defined.

On the 9th March, the planetary disc had disappeared, in place of

which there was a mere coma, having a thickening towards the middle. Both streamers of the tail had disappeared, and the dark axial space was filled with a faint luminosity. The tail, however, had become longer.

The tail, which was at this time preceding the head, was curved slightly towards the aphelion, and was also in advance of a line joining the sun with the comet's head.

With a small telescope of low power, indications of a nucleus often appeared, but were as often dispelled by the employment of more powerful instruments. When the tail appeared to the naked eye upwards of 40° long, nothing like a solid or stellar nucleus could be discovered. There was only a mass of vapour, which, though condensed in certain parts, was still permeable to the rays of the minutest stars.

3. On the Existence of Fluorine in the Bones from Arthur's Seat. By Dr G. Wilson.

4. On the Composition of the Bones from Arthur's Seat. By Dr Christison.

The author found that the bones of animals lately disinterred in the course of the new drive, contained $\frac{1}{8}$ of the quantity of gelatine common in recent bones.

The following Gentlemen were duly elected Ordinary Fellows of the Society:—

George Turnbull, Esq., W.S.
George J. Gordon, Esq.

The following Donations to the Society's Library were announced:—

The London University Kalendar, 1846.—*By the University.*

Journal of the Asiatic Society of Bengal, No. 159.—*By the Society.*

The Electrical Magazine. Conducted by Mr Charles V. Walker. January 1846.—*By the Editor.*

Twenty-fifth Report of the Council of the Leeds Philosophical and Literary Society for Session 1844-45.—*By the Society.*

Biographical Notice of the late Sir John Robison, K.H., Sec. R.S. Ed. By Professor Forbes.—*By the Author.*

Il Cimento; Giornale di Fisica, Chimica e Storia Naturale. 1844 and 1845, January to Aug.—*By Professor Forbes.*

Nieuwe Verhandelingen der Eerste Klasse von het Koninklijk-Nederlansche Instituut van Wetenschappen, Letterkunde en Schoone Kunsten te Amsterdam. Deel XII., Stuk 1.—*By the Institut.*

Monday, 6*th April* 1846.

SIR THOMAS M. BRISBANE, Bart., President, in the Chair.

The following Communications were read :—

1. On the Description of Oval Curves, and those having a plurality of Foci. By Mr Clerk Maxwell junior; with remarks by Professor Forbes. Communicated by Professor Forbes.

Mr Clerk Maxwell ingeniously suggests the extension of the common theory of the foci of the conic sections to curves of a higher degree of complication in the following manner :—

(1.) As in the ellipse and hyperbola, any point in the curve has the *sum* or *difference* of two lines drawn from two points or *foci* = a constant quantity, so the author infers, that curves to a certain degree analogous, may be described and determined by the condition that the simple distance from one focus *plus* a multiple distance from the other, may be = a constant quantity; or more generally, m times the one distance + n times the other = constant.

(2.) The author devised a simple mechanical means, by the wrapping of a thread round pins, for producing these curves. See Figs. 1 & 2 (Plate II.) He then thought of extending the principle to other curves, whose property should be, that the sum of the simple or multiple distances of any point of the curve from three or more points or foci, should be = a constant quantity ; and this, too, he has effected mechanically, by a very simple arrangement of a string of given length passing round three or more fixed pins, and constraining a tracing point, P. See Fig. 3. Farther, the author regards curves of the first kind as constituting a particular class of curves of the second kind, two or more foci coinciding in one, a focus in which two strings meet being considered a double focus; when three strings meet a treble focus, &c.

Professor Forbes observed that the equation to curves of the first class are easily found, having the form

$$\sqrt{x^2+y^2}=a+b\sqrt{(x-c)^2+y^2},$$

which is that of the curve known under the name of the First Oval of Descartes.* Mr Maxwell had already observed that when one of the foci was at an infinite distance, (or the thread moved parallel to itself, and was confined in respect of length by the edge of a board,) a curve resembling an ellipse was traced; from which property Professor Forbes was led first to infer the identity of the oval with the Cartesian oval, which is well known to have this property. But the simplest analogy of all is that derived from the method of description, r and r' being the radients to any point of the curve from the two foci;

$$m\,r + n\,r' = \text{constant},$$

which in fact at once expresses on the undulatory theory of light the optical character of the surface in question, namely, that light diverging from one focus F without the medium, shall be correctly convergent at another point f within it; and in this case the ratio $\frac{n}{m}$ expresses the index of refraction of the medium.†

If we denote by *the power of either focus* the number of strings leading to it by Mr Maxwell's construction, and if one of the foci be removed to an infinite distance, if the powers of the two foci be *equal* the curve is a parabola; if the power of the nearer focus be *greater* than the other, the curve is an ellipse; if the power of the infinitely distant focus be the greater, the curve is a hyperbola. The first case evidently corresponds to the case of the reflection of parallel rays to a focus, the velocity being unchanged after reflection; the second, to the refraction of parallel rays to a focus in a dense medium (in which light moves slower); the third case to refraction into a rarer medium.

The ovals of Descartes were described in his Geometry, where he has also given a mechanical method of describing one of them,‡ but only in a particular case, and the method is less simple than Mr Maxwell's. The *demonstration* of the optical properties was given by Newton in the *Principia*, Book I., prop. 97, by the law of the sines; and by Huyghens in 1690, on the Theory of Undulations in his *Traité de la Lumière*. It probably has not been suspected that so easy and elegant a method exists of describing these curves by the use of a thread and pins whenever the powers of the foci are com-

* Herschel on Light, Art. 232; Lloyd on Light and Vision, Chap. vii.

† This was perfectly well shewn by Huyghens in his Traité de la Lumière, p. 111. (1690.)

‡ Edit. 1683. Geometria, Lib. II., p. 54.

mensurable. For instance, the curve, Fig. 2, drawn with powers 3 and 2 respectively, give the proper form for a refracting surface of glass, whose index of refraction is 1·50, in order that rays diverging from f may be refracted to F.

As to the higher classes of curves with three or more focal points, we cannot at present invest them with equally clear and curious physical properties, but the method of drawing a curve by so simple a contrivance, which shall satisfy the condition

$$m\,r + n\,r' + p\,r'' + \&c. = \text{constant},$$

is in itself not a little interesting; and if we regard, with Mr Maxwell, the ovals above described, as the limiting case of the others by the coalescence of two or more foci, we have a farther generalization of the same kind as that so highly commended by Montucla,* by which Descartes elucidated the conic sections as particular cases of his oval curves.

2. On the Influence of Contractions of Muscles on the Circulation of the Blood. By Dr Wardrop.

In this paper, Dr Wardrope states that he has endeavoured to shew, by a series of observations and experiments, that the muscles, besides being the active organs of motion, perform, by their contractions, an important office in the circulation of the arterial as well as venous blood; an office which has not hitherto been described by physiologists, but which appears to be capable of explaining several interesting phenomena in the living body, of which no satisfactory account has yet been given.

3. On the Solubility of Fluoride of Calcium in Water, and the relation of this property to the occurrence of that Substance in Minerals, and in recent and Fossil Plants and Animals. By Dr G. Wilson.

After a preliminary reference to the existence of fluorine in recent and fossil bones, Dr Wilson stated that he had made a series of experiments with a view to discover what solvent carried fluoride of calcium into the tissues of plants and animals. His first trials were made with carbonic acid, which was passed in a current through water containing pure fluor-spar in fine powder suspended in it. The fluor was by this treatment dissolved, yielding a solution which precipitated oxalate of ammonia, and when evaporated left a residue

* Histoire des Mathematiques. *First Edit.* II., 102.

which, on being heated with sulphuric acid, gave off hydrofluoric acid.

The author was, in consequence, inclined to suppose that carbonic acid conferred upon water the power of dissolving fluoride of calcium. But on observing that long after the whole of that gas had been expelled by warming the liquid, the latter remained untroubled, he became satisfied that water alone can dissolve fluoride of calcium, contrary to the universal statement of writers on chemistry.

On prosecuting the inquiry, he found that water at 212° dissolved more of the fluor than water at 60°, but he has not yet ascertained the proportion taken up by that liquid at either temperature.

The aqueous solution of fluoride of calcium was found to give, with salts of baryta, a precipitate which required a large addition of hydrochloric or nitric acid to redissolve it. The author pointed out the difficulty which must in consequence occur, in distinguishing between dissolved fluoride and sulphates, and suggested that fluorides may have been mistaken for sulphates in the analysis of mineral water.

He referred also to the objection which must now lie against the present method of determining the quantity of fluorine present in bodies, consisting, as it does, in converting that element into fluoride of calcium, which, in the course of the necessary analytical operations, is washed freely, and must be sensibly diminished in quantity; a fact which has of necessity been hitherto overlooked. Dr Wilson stated that he was not yet able to suggest an unexceptionable quantitative process; but that the fluoride of barium, being much less soluble than the fluoride of calcium, might, in the meanwhile, be substituted for it in the estimation of fluorine.

The author proceeded to state, that in consequence of the observations he had made as to the solubility of fluoride of calcium on water, he had been led to look for that body in natural waters, and had found it in one of the wells of Edinburgh, namely, in that supplying the brewery of Mr Campbell in the Cowgate, behind Minto House. At the same time, he stated that preceding observers had already found it in other waters. He believed, however, that he was the first to detect it in sea-water, where, by using the bittern or mother-liquor of the salt-pans in which water from the Frith of Forth is evaporated, he had found it present in most notable quantity. The author referred to the presence of fluorine in sea-water, as adding another link to the chain of observed analogies between that body and chlorine, iodine, and bromine.

Dr Wilson further stated, that he had confirmed the observations of Will, as to the presence of fluorine in plants, and Berzelius' discovery that fluorine exists in the secretion from the kidneys; and had, in addition, detected fluorine in the blood and milk, in neither of which has it been hitherto suspected to occur. The paper was concluded by some observations on the presence of fluorine in fossils, and its relations to animal life.

The following Gentleman was elected an Ordinary Fellow:—

William Balfour, Esq.

The following Donations to the Library were announced:

Proceedings of the American Philosophical Society. Vol. IV., Nos. 32 and 33.

Transactions of the American Philosophical Society held at Philadelphia, for promoting Useful Knowledge. (New Series), Vol. IX., Part 2.—*By the Society.*

Flora Batava. Nos. 139 and 140.—*By the King of the Netherlands.*

Journal of the Statistical Society of London. Vol. IX., Part 1. March 1846.—*By the Society.*

The American Journal of Arts and Science, conducted by Professor Silliman, B. Silliman junior, and James D. Dana, for March 1846.—*By the Editors.*

The Quarterly Journal of the Geological Society. Vol. I., and Vol. II., Part 1.—*By the Society.*

Proceedings of the Royal Astronomical Society. Vol. VI., Nos. 9 to 17, and Vol. VII., Nos. 1, 2, 3.

Memoirs of the Royal Astronomical Society. Vol. XV. *By the Society.*

Meteorological Observations for 1842 and 1843, made at the Bombay Government Observatory. By George Buist, LL.D., in the charge of the Observatory.

Magnetic Observations made at the Bombay Government Observatory from May 1842 to Dec. 1843. By George Buist, LL.D.

Tracings of the Wind-Gauge for 1842 and 1843, made at the Bombay Government Observatory from May 1842 to Dec. 1843. By George Buist, LL.D.—*By George Buist, LL.D.*

Journal of the Asiatic Society of Bengal. No. 162.—*By the Society.*

Memoirs and Proceedings of the Chemical Society. Part 16.—*By the Society.*

Maps of the Geological Survey of the United Kingdom of Great Britain.—*By Sir H. T. De la Beche, Director-General of the Geological Survey.*

Monday 20*th April* 1846.

The RIGHT REV. BISHOP TERROT, Vice-President, in the Chair.

The following communications were read:—

1. On the Constitution and Properties of Picoline, a new organic base from Coal-Tar. By Dr T. Anderson.

The author, after alluding to the investigations of the oily bases in coal tar, by Hoffmann, who had failed in obtaining Runge's pyrrol, stated, that in searching for that substance among the more volatile products of the distillation of coal-tar, he had been enabled to confirm its existence in small quantity, as well as that of the new base to which he has given the name of picoline.

Picoline is obtained in the pure state by several successive distillations of the mixed bases contained in coal-tar, after the perfect separation of pyrrol and empyreumatic oils, by processes described at length in the paper, and finally by collecting the product which distilled at 272° Fahrenheit. The analysis of the base purified by these processes, gave the following mean result, viz.:—

	Mean.	Calculated.
Carbon, ...	77·17	77·29
Hydrogen, ...	7·69	7·43
Nitrogen, ...	15·14	15·28
	100·00	100·00

This corresponds with the formula $C_{12}\ H_7\ N$, which is that of aniline; and the author further found by the analysis of the platinum salt of picoline, that its atomic weight is identical with that of aniline.

The identity in constitution, however, of these substances is accompanied by an entire difference in properties. Picoline having a specific gravity of 0·955 boiling at 272°, and being soluble in water in all proportions; it is incapable of giving the violet colour with chloride of lime, and the yellow colour to fir wood moistened with hydrochloric acid, which are produced by aniline, and it gives, with chloride of gold, a highly characteristic precipitate, soluble in hot water, and deposited, on cooling, in delicate yellow needles. The author observed that these

properties approximated in some respects to those of Unverdorben's odorin, and stated that he had separated from the oleum cornu cervi, a mixture of several oily bases, one of which was soluble in water, but which did not agree perfectly either with the characters of picoline, or those which Unverdorben has attributed to odorin.

The author then details the properties and constitution of the compounds of picoline, which differ in many respects from those of aniline. It gives with sulphuric acid an acid compound which deliquesces rapidly in the air, and which has the formula $C_{12} H_7 N + 2 (H O, S O_3)$. Its platinum salt is identical in constitution with that of aniline, but its mercury compound is $C_{12} H_7 N + Hg Cl_2$, while that of aniline is $2 (C_{12} H_7 N) + 3 Hg Cl_2$.

The author then treats of the products of the decomposition of picoline, a branch of the subject on which, owing to the small quantity of the substance at his disposal, he was enabled only to make a few observations, which, however, tend to shew that the action of reagents on it is remarkably different from that which they produce on aniline. The action of nitric acid was found to be extremely slow and partial, long continued ebullition producing only a very slight evolution of nitrous acid, without any of the blue colour which aniline gives, and apparently without the formation of carbazotic acid. Bromine gives an oily product heavier than water, and different, of course, from the solid bromaniloid of Fritsche.

The author concludes by remarking, that the present is the first perfectly established case of isomerism among organic bases, those previously recorded being devoid of absolutely conclusive evidence, and by pointing out the interest which attaches to the isomerism of two substances such as aniline and picoline, which are members of one of the most interesting and extensive groups of organic substances, the indigo, salicyl, and benzoil series.

2. Notice of Polished and Striated Rocks recently discovered on Arthur Seat, and in some other places near Edinburgh. By David Milne, Esq.

Mr Milne stated, that, in the gully situated between Arthur Seat and Sampson's Ribs, a great extent of rock had been recently exposed (by the removal of clay and other superficial deposits) which was found to be smoothed as well as furrowed or scratched.

The gully is about 30 feet wide, at the lowest level to which it

has been hollowed out, and at one part, both of its sides are composed of these smoothed furrowed rocks; but, in general, it is only on one side, viz., that next to Arthur Seat, that rock exists. There, the appearances of smoothing and rutting extend for about 80 yards.

The gully runs about NW. and SE. by compass. The highest point in it is near the north end. At both ends it is open and sinks to a level with the adjoining level country. The gully is about 200 feet above the level of Duddingston Loch, and 400 feet above the sea. Arthur Seat forms on the east side of it a precipitous cliff of about 250 feet.

The walls of the gully consist (so far as yet exposed, in the formation of the Victoria road), for about 5 feet upwards, of vertical rock.

This rock towards the north end of the gully is a compact porphyry; towards the south end, of friable porphyry. At the north end the polishing has been greatest.

The scratches are in general nearly horizontal; a few slope upwards to the south; these are at the north end of the gully, where it is narrowest.

The longest scratches are about 6 feet long, from $\frac{1}{3}$ to $\frac{1}{2}$ inch deep and an inch wide.

There are, especially towards the south end of the gully, many spots of a few inches square, where there has been neither polishing nor scratching. These all face towards the south.

The deposit immediately above those rocks, and which has completely filled up the gully, is a brown tenacious clay, full of boulders of all sizes. The boulders consist of traps (some of them of rock not existing in the neighbourhood) and sedimentary rocks. Whilst there are sandstone fragments, which are very similar to those on Salisbury Crag, there are limestones, supposed not to exist nearer than Fife.

This boulder clay is not so tenacious as the blackish-blue boulder clay generally prevalent in the Lothians. It, however, resembles in all respects a deposit of the same kind, existing at the foot of Sampson's Ribs, which is about 160 feet below the level of the gully.

Above the boulder clay in the gully there is a mass of debris, derived apparently from the crumbling of the rocks above on the face of Arthur Seat. Three species of marine shells have been found in this mass; but, as human bones and Roman remains have also been discovered in it, the probability is, that these shells have been brought by human hands.

In the cuttings for the North British Railway, between Arthur Seat and Musselburgh, the upper sides of the large boulders are generally found smoothed and scratched. The scratches seem to be from NW. to WNW. by compass. On some of the boulders there are indications of more recent scratches running W. ½ S. by compass.

The boulders in the railway cuttings between Haddington and Dunbar exhibit scratches running from NW. to WNW.

The opinion formed by the author on these data was,—

(1.) That the agent which had polished and scratched the rocks on Arthur Seat, was the same as that which had polished and scratched the boulders.

(2.) That it had acted from the north-westward over a large and low district of country.

(3.) That the polishing and scratching had been effected by the gravel and angular blocks existing in the boulder clay and diluvial gravel.

(4.) That there had been rushes of water along the country, which bore along the mud, sand, gravel, and boulders now spread over the country, and which, in passing over the rocks and large boulders, smoothed and rutted them.

(5.) That, at this period and subsequently, water must have stood, in a comparatively tranquil state, above the level of Sampson's Ribs, to account for the beds of sand existing on the south side of Arthur Seat, and at a level of 200 feet above Duddingston Loch.

(6.) That the outline or configuration of the district, thus submerged, could not have been materially different from what it now presents.

3. Results of the Makerstoun Observations, No. II. On the Relation of the Variations of the Vertical Component of the Earth's Magnetic Intensity to the Solar and Lunar Periods. By J. Allan Broun, Esq. Communicated by General Sir T. M. Brisbane, Bart.

The following results are deduced from the observations of the balance or vertical force magnetometer described in the Introduction to the Makerstoun Observations. The observations were corrected for temperature by a method previously described.

The diurnal variation of the vertical component consisted, in the year 1844, of three maxima and three minima, occurring as follows :—

	H. M.	
The principal minimum	at 14 10	Makerstoun mean time.
A secondary maximum	at 20 50	....
A secondary minimum	at 22 50	....
The principal maximum	at 5 30	....
A third minimum	at 12 10	....
A third maximum	at 13 10	....

The third maximum and minimum are but faintly marked. The form of the diurnal curve, and the periods and number of maxima and minima, vary throughout the year; neglecting the inferior maximum and minimum, the diurnal curve is single in winter and double in summer, the principal minimum occurs at noon in summer.

The diurnal range is greatest at the equinoxes, and least at the solstices, the range at the former being nearly two and a half times that at the latter.

Each of the mean values of the vertical component at 21^h and 0^h, is nearly equal to the mean for the year. The secular variation is negative.

The investigation for the relation of the variations of the vertical component to the moon's hour angle, gives for the mean of the two years 1844 and 1845—

The principal minimum about 5 hours before the moon's passage of the inferior meridian.
The principal maximum about 3 hours after ....
A secondary minimum about 4 hours before ....superior...........
A secondary maximum about 1 hour after ....

The results for each year differ little from the mean of both; the secondary maximum and minimum are not so well shewn in 1844 as in 1845. The observations of single months, when free from magnetic disturbances, have been found to give the same periods.

Investigations were made for a period connected with the moon's phase or synodical revolution; each of the years 1844 and 1845 indicates maxima of the vertical component near the quadratures, and minima near the syzygies.

4. Two Verbal Notices. (1.) On the Geology of Arthur Seat. (2.) On the Dentition of the Walrus. By the Rev. Dr Fleming.

(1.) Dr Fleming read the following passage from Townson's "Tracts and Observations in Natural History," Edin. 1799, when treating of the "Rocks in the Vicinity of Edinburgh:"—"The first of the chains or ranges of rocks that I lately described, as lying at

the back of Salisbury Crags, extends from Arthur Seat to St Anthony's chapel. It is composed of basalt and sandstone, neither of which are like the whin and sandstone of Salisbury Crags. The basalt is the same as that near Duddingston Loch. The stratified matter forms a bed two or three yards thick near St Anthony's chapel. Some of it is very hard, and strikes fire with steel, but effervesces with acids, and has an argillaceous smell, but the greatest part is soft and friable, and seems to be merely the finer debris and powder of the breccia, perhaps a kind of trass or terrass. *It contains a great many vegetable impressions, with the charred matter still existing.* They appear to be the same which are so frequently found in the strata that accompany coal. The large irregular basaltic columns at St Anthony's chapel rest upon this." P. 214. Dr Fleming stated that he was induced to bring into notice this seemingly neglected observation of Townson, as likely to interest those members of the Society who attach themselves to the study of the geology of the district.

(2.) Mr Lyell, in the first volume of his "Travels in North America," London 1845, p. 258, has the following remarks in reference to the skull of a Walrus, from the tertiary beds of Gayhead, in the island of Martha's Vineyard, Mussachusetts,—"I purchased from a fisherman, residing near the promontory, a fossil skull, which he told me had fallen out of this conglomerate upon the beach below. It retained but a small portion of the original animal matter, was slightly rolled, and Mr Owen recognised it as the cranium of a Walrus or Morse, nearly allied to the existing species (*Trichecus Rosmarus*, Linn.) On comparison it was observed to differ from it, in having *six* (a misprint for *three*, as is evident from the figure given of the organism in Plate V.) molar teeth, instead of four on each side of the upper jaw. There are eleven specimens of recent species in the College of Surgeons, in all of which there are no more than four grinders on each side. The tusk, also, of the Gayhead fossil has a rounder form than that of the recent Morse (see Plate V.)" Dr Fleming stated that, on perusing the above passage, he was induced to examine the examples of the recent skulls of the Walrus in his possession. This examination led him to observe a degree of irregularity in the dentition of this animal, differing from the statement in the passage, as depending on the appearances of the eleven specimens in the Museum of the College of Surgeons of London. He placed on the table four examples.

1. In the first specimen there were three grinders on each side,

as in the fossil example, and an alveolus on each side, behind, nearly filled up.

2. In the second example there were four grinders on the one side and five in the other, the last being small.

3. In the third example there were four grinders on each side, and two shallow sockets on each side behind, out of which the teeth had recently fallen, and the trace of a seventh obliterated alveolus on each side.

4. In the fourth example there were five grinders on each side and one nearly obliterated alveolus on each side.

The incisors appeared to be equally irregular in their number and development. Thus, in the 1*st*, there was one incisor on the one side and only an obliterated socket in the other. In the 2*d*, one incisor on one side. In the 3*d*, two incisors on one side and one in the other. In the 4*th*, one on each side.

Dr Fleming concluded his communication by stating, that the few examples which were before the Society, while they indicated very plainly an irregularity in the dentition of the Walrus, not perceived in the eleven London examples, forbade our attaching any importance to the Gayhead organism, as referable to an extraordinary variety, and still less to a new species of the genus Trichecus.

The following Gentleman was elected an Ordinary Fellow :—

Dr L. Schmitz, Rector of the High School.

The following donations to the Society's Library were announced :—

Metaphysical Analysis, revealing, in the Process of the Formation of Thought, a new Doctrine of Metaphysics. By J. W. Tombs. —*By the Author.*

Novorum Actorum Academiæ Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum, voluminis vicesimi primi pars prior.—*By the Academy.*

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. Tomes XXII., Nos. 2 to 12—*By the Academy.*

Journal of the Asiatic Society of Bengal. No. 163.—*By the Society.*

A Work on the Science of Mathematics, embracing Conic Sections, Perspective, &c. By Nuwab Shums-ool-oomiah of Hyderabad; the Illustrations lithographed by the Author.—*Dr Burt.*

Fig. 1. Two Foci. Ratios 1 : 2.

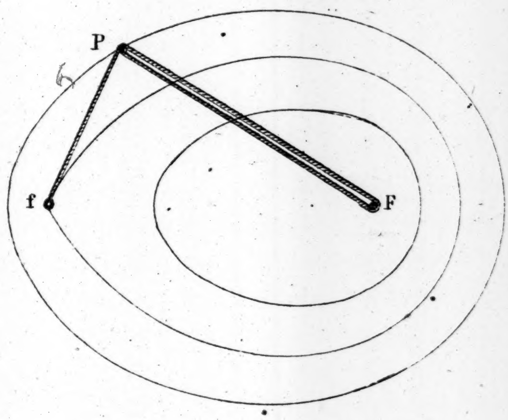

Fig. 2. Two Foci. Ratios 2 : 3.

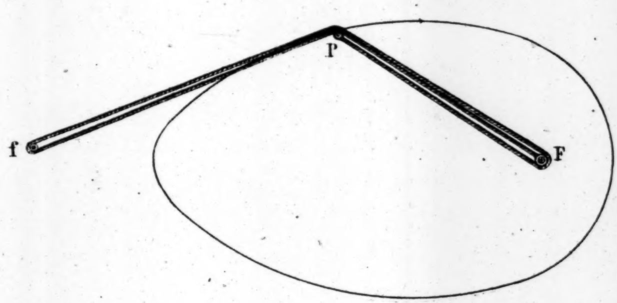

Fig. 3. Three Foci, Ratios of Equality.